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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/402,482	11/09/1999	CHRISTOPH GROHMANN	P18477	6003

7590 08/28/2002

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RESTON, VA 20191

EXAMINER

KIBLER, VIRGINIA M

ART UNIT	PAPER NUMBER
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2623

DATE MAILED: 08/28/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/402,482

Applicant(s)

GROHMANN ET AL.

Examiner

Virginia M Kibler

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2623

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-37 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 14-37 is/are rejected.
- 7) ☒ Claim(s) 16 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities: the word “the” before “device” on page 5, line 11 should be deleted, the word “are” after “assembly” on page 10, line 6 should be changed to “is,” and the word “define” on page 10, line 6 should be changed to “defines. ”

Appropriate correction is required.

Claim Objections

2. Claim 16 is objected to because of the following informality: the phrase “coupled connected” is confusing. It should be replaced by “coupled.” Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 24 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Claim 24 recites “fully automated 100% X-ray inspection.” The specification is not clear on what is meant by 100% X-ray inspection.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 14-20, 22, 23, 27-29, 32, and 33-35 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Adams et al. (5,561,696).

Regarding claim 14, Adams et al. ("Adams") discloses an apparatus or "device" for inspecting a test object (Abstract, lines 1 and 5) with moveably arranged X-ray beam tube (Figure 1, element 20) and detector 30 and a stationary object 10. The X-ray beam tube and the detector both have a small field of view in relation to a horizontal extent of an area of the test object to be inspected as shown in Figure 3a. The X-ray beam 282 illuminates a region 283 of the circuit board 210 (Col. 15, lines 64-66).

Regarding claim 32, Adams discloses a method or “process” for inspecting a test object (Abstract, lines 1 and 5). The arguments analogous to those presented above for claim 14 are applicable to claim 32. Note that the test object is fixedly mounted by fixture 220 in Figure 3a.

Regarding claim 15, Adams discloses a carrier adapted to be fixedly mounted during inspection. The test object is mounted to a fixture 220 or “carrier” which is attached to a positioning table 230 capable of moving the fixture and test object (Col. 15, lines 18-21).

Regarding claim 16, Adams discloses a master computer 270 or a “computing device” being coupled to the detector as shown in Figure 3a.

Regarding claim 17, Adams discloses a high speed image analysis computer 272 or an “analysis unit” being connected to the computing device 270 as shown in Figure 3a.

Regarding claim 18, Adams discloses an X-ray beam tube comprising a microfocus tube with a focal spot approximately 20-microns in diameter (Col. 17, lines 4-5).

Regarding claim 19, Adams discloses a detector comprising a CCTV camera (Col. 19, lines 15-16) inherently will have a CCD chip arranged on a taper.

Regarding claim 20, Adams discloses an X-ray beam tube and detector adapted for two-dimensional inspection of the test object (Col. 11, lines 3-4).

Regarding claim 22, Adams discloses a device wherein the test object comprises a printed circuit board 210 as shown in Figure 3a (Col. 14, lines 62-63).

Regarding claim 23, Adams discloses a device adapted for X-ray inspection of soldered joints 214 on printed circuit boards 210 as shown in Figure 3a and 3b (Col. 15, lines 6-8).

Regarding claims 27 and 33, Adams discloses a device wherein X-ray beam tube and detector are adapted to move parallel to each other as illustrated in Figure 1. Parallel planes 62

and 64 define the rotation of the X-ray beam tube 20 and detector 30, respectively (Col. 14, lines 3-5).

Regarding claims 28 and 34, Adams discloses a device wherein X-ray beam tube and detector are adapted to move in a same direction as shown in Figure 1. The preferred alignment and synchronization of the X-ray beam tube and the detector are maintained by a feedback system (Col. 21, lines 25-28). Figure 1 illustrates that the X-ray beam tube and detector are adapted to move the same direction. Hence, the X-ray beam tube and the detector are synchronized or “moved together in the same direction.”

Regarding claims 29 and 35, the arguments analogous to those presented above for claims 28 and 34 are applicable to claims 29 and 35.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 21, 24, 31, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adams et al. (5,561,696) in view of Parker (5,461,653).

Regarding claim 21, Adams et al. (“Adams”) only discloses an X-ray beam tube and detector adapted for two-dimensional inspection of the test object (Col. 11, lines 3-4). Adams does not disclose a device adapted for three-dimensional inspection of the test object. However,

Parker teaches that it is known to have an X-ray beam tube 2 and a detector 46 adapted for three-dimensional inspection of a test object (Col. 4, line 1). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the device disclosed by Adams to be adapted for three-dimensional inspection of a test object, as taught by Parker, in order to enable more accurate inspection of the test object.

Regarding claim 24, Adams discloses a device adapted for X-ray inspection of soldered joints 214 on printed circuit boards 210 as shown in Figure 3a and 3b (Col. 15, lines 6-8). The disclosed device is adapted for fully automated inspection of all solder connections on a circuit board (Col. 28, line 18). Adams does not recognize the device being adapted for 100% X-ray inspection. However, Parker teaches that it is known to have 100% of the X-rays irradiating the object (Abstract, line 18). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the X-ray inspection as disclosed by Adams to include 100% X-ray inspection, as taught by Parker, in order to promote enhanced detection sensitivity (Col. 3, lines 59-62).

Regarding claims 31 and 37, Adams does not recognize moving the X-ray beam tube and detector parallel to the test object. However, Parker teaches that it is known to move the X-ray beam tube 2 and the detector 48 parallel to the test object 10 as shown in Figure 2. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the movement of the X-ray beam tube and detector as disclosed by Adams to include moving them parallel to the test object, as taught by Parker, in order to inspect soldered joints.

9. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adams et al. (5,561,696) in view of Armistead (4,852,131).

Regarding claim 25, Adams et al. ("Adams") discloses an analysis unit including a learning mode in which a set of testing algorithms is transmitted to the analysis unit (Figure 48, element 4040). Adams discloses using algorithms to generate a dynamic block of learned-joint data to store information for each individual soldered joint rather than a characteristic vector (Col. 59, lines 8-10). The dynamic block of data is optimized by updating the dynamic block of data during learning (Col. 59, lines 15-19) based on the analysis of multiple boards (Col. 59, lines 12-13). However, Armistead teaches that it is known to use learned characteristic vectors. Armistead's learning mode includes component and bond defect vectors or "learned characteristic vectors" (Col. 6, lines 43-46). The characteristic vector is updated or "optimized" in step 6F of Figure 11. The learning mode provides a normalized model image or a "defect-free" representation (Col. 8, lines 36-45). It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the learning mode disclosed by Adams to include a characteristic vector and a defect-free representation, as taught by Armistead, in order to provide a model of each soldered joint for inspection.

10. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Adams et al. (5,561,696) in view of Armistead (4,852,131) in further view of Rooks (5,719,952).

Regarding claim 26, the arguments analogous to those presented above for claim 25 are applicable to claim 26. The testing mode disclosed by Adams et al. ("Adams") does not recognize the need for a pad image buffer, learned characteristic vectors with tolerances, nor a correlation between the learned characteristic vectors and the soldered joint under inspection. However, Armistead teaches that it is known to include learned characteristic vectors with tolerances in an inspection (Figure 9, S2) or "testing" mode. Armistead's testing mode includes

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component and bond defect vectors or “learned characteristic vectors” (Col. 6, lines 43-46) with tolerances (Col. 6, lines 32-36). To test a soldered joint, the image data comparing computer 61 is used to determine a correlation between the learned characteristic vectors and the soldered joint under test (Col. 8, lines 46-50). Armistead does not recognize the need for a pad image buffer. However, Rooks teaches that it is known to use a frame or “pad image” buffer (Col. 4, line 46). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the analysis unit disclosed by Adams to include learned characteristic vectors and a correlation between the learned characteristic vectors and the soldered joint under inspection, as taught by Armistead, and a pad image buffer, as taught by Rooks, in order to further analyze the solder joint under inspection.

11. Claims 30 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adams et al. (5,561,696) in view of Ichinose et al. (5,463,667).

Regarding claims 30 and 36, Adams et al. (“Adams”) does not recognize moving the X-ray beam tube and detector in opposite directions. However, Ichinose et al. (“Ichinose”) teaches that it is known to move the X-ray beam tube 4 and detector 6 in opposite directions as shown in Figure 5. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the movement of the X-ray beam tube and detector as disclosed by Adams to include moving them in opposite directions, as taught by Ichinose, in order to detect soldered joints.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Pat. No. 5,388,136 to Halliday et al. is cited for X-ray inspection apparatus for electronic circuits;

U.S. Pat. No. 6,185,273 to Sperschneider is cited for process and circuit arrangement for testing solder joints; and

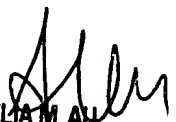
U.S. Pat. No. 5,978,440 to Kang et al. is cited for tomographic apparatus and method of obtaining an arbitrary cross-sectional image.

Contact Information

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Virginia M Kibler whose telephone number is (703) 306-4072. The examiner can normally be reached on M-F 8:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9314 for regular communications and (703) 872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 306-0377.


AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

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